DEPARTAMENTO DE ELECTRÓNICA, TELECOMUNICAÇÕES E INFORMÁTICA

MESTRADO INTEGRADO EM ENG. DE COMPUTADORES E TELEMÁTICA

FUNDAMENTOS DE REDES

CONFIGURATION COMMANDS OF CISCO ROUTER

General configuration commands

- Enter the privileged EXEC mode

```
Router>enable
```

- Exit the privileged EXEC mode

```
Router#disable
```

- Enter the global configuration mode from the terminal

```
Router#configure terminal
```

- Exit the global configuration mode

```
Router#end
```

- Show actual (running) configuration

```
Router#show running-config
```

- Show startup configuration

```
Router#show startup-config
```
or
```
Router#show config
```

- Delete startup configuration

```
Router#erase startup-config
```
or
```
Router#write erase
```

- Show MAC addresses of the interfaces

```
Router#show interfaces
```

1. Configuration of IP addresses

Consider the example network shown in the following figure with class C IP addresses (subnet mask 255.255.255.0):

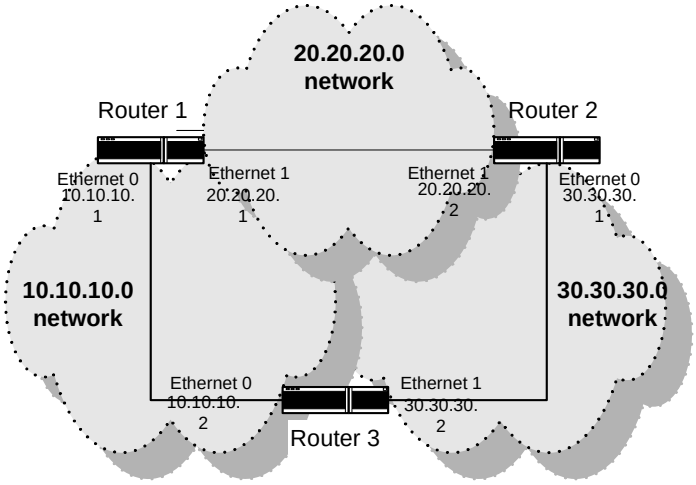


Figure 1: Network consisting of three IP networks

In order to configure the IP addresses (and their respective subnet masks) of the Router 1 interfaces, the following commands must be executed:

Router1#configure terminal	Enter global configuration mode
Router1(config)#interface Ethernet 0	Enter interface configuration mode
Router1(config-int)#ip address 10.10.10.1 255.255.255.0	Configure IP address and subnet mask
Router1(config-int)#no shutdown	Activate the Ethernet 0 interface
Router1(config)#interface Ethernet 1	Enter interface configuration mode
Router1(config-int)#ip address 20.20.20.1 255.255.255.0	Configure IP address and subnet mask
Router1(config-int)#no shutdown	Activate the Ethernet 1 interface
Router1(config-int)#end	Exit global configuration mode
Router1#write	Save this configuration to the startup configuration

2. Configuration of static routes

Considering Figure 1 as an example, in order to configure a clockwise direction static route from Router 1 to network 30.30.30.0 the following procedure must be taken:

Router1#configure terminal	Enter global configuration mode
Router1(config)#ip route 30.30.30.0 255.255.255.0 20.20.20.2	Define the path to network 30.30.30.0 through *router 2*
Router1(config)#end	Exit global configuration mode
Router1#write	Save this configuration to the startup configuration

In order to delete a previously configured static route, the following commands must be used:

Router1#configure terminal	Enter global configuration mode
Router1(config)#no ip route 30.30.30.0 255.255.255.0 20.20.20.2	Delete the previously configured static route
Router1(config)#end	Exit global configuration mode
Router1#write	Save this configuration to the startup configuration

3. Configuration of the RIP protocol

The RIP routing protocol can be programmed in a router using the following procedure (this example refers to Router 1 of Figure 1):

Router1#configure terminal	Enter global configuration mode
Router1(config)#router rip	Initialize the RIP process
Router1(config-router)#network 10.10.10.0	Run RIP process in the interface to network 10.10.10.0
Router1(config-router)#network 20.20.20.0	Run RIP process in the interface to network 20.20.20.0
Router1(config-router)#end	Exit global configuration mode
Router1#write	Save this configuration to the startup configuration

The configuration of the RIP protocol can be cancelled in the following way (this example refers to Router 1 of Figure 1):

Router1#configure terminal	Enter global configuration mode
Router1(config)#no router rip	Cancel the RIP process
Router1(config-router)#end	Exit global configuration mode
Router1#write	Save this configuration to the startup configuration

4. Configuration of the *split-horizon* option

The router interfaces are configured by default with *split-horizon*. However, it is possible to deactivate *split horizon* using the *no ip split-horizon* command. Considering the example of Router 1 in Figure 1, deactivating *split horizon* in both interfaces can be done by executing the following commands:

Router1#configure terminal	Enter global configuration mode
Router1(config)#interface Ethernet 0	Enter interface Ethernet 0 configuration mode
Router1(config-if)#no ip split-horizon	Deactivate split-horizon
Router1(config-if)#exit	Exit interface Ethernet 0 configuration mode
Router1(config)#interface Ethernet 1	Enter interface Ethernet 1 configuration mode
Router1(config-if)#no ip split-horizon	Deactivate split-horizon
Router1(config-if)#end	Exit global configuration mode
Router1#write	Save this configuration to the startup configuration

5. Configuration of the OSPF protocol

Configuration of the OSPF protocol (taking Router 1 of Figure 1 as an example):

Router1#configure terminal	Enter global configuration mode
Router1(config)#router ospf 1	Initialize the OSPF routing process with ID 1
Router1(config-router)#network 10.10.10.0 0.0.0.255 area 0	Associate network 10.10.10.0 with the OSPF process and define the area that the network belongs to
Router1(config-router)#network 20.20.20.0 0.0.0.255 area 0	Associate network 20.20.20.0 with the OSPF process and define the area that the network belongs to
Router1(config-router)#end	Exit global configuration mode
Router1#write	Save this configuration to the startup configuration

Notes: (i) in the *network* command, the subnet mask is defined with its bits denied, i.e., 0.0.0.255 instead of 255.255.255.0 (ii) at least one of the networks must belong to area 0 (*backbone*).

In order to cancel the OSPF configuration, the following procedure must be adopted (the example refers to Router 1 of Figure 1):

Router1#configure terminal	Enter global configuration mode
Router1(config)#no router ospf 1	Cancel the OSPF process
Router1(config-router)#end	Exit global configuration mode
Router1#write	Save this configuration to the startup configuration

6. Configuration of the interface costs in the OSPF protocol

Taking interface Ethernet 1 of Router 1 in Figure 1 as example:

Router1#configure terminal	Enter global configuration mode
Router1(config)#interface Ethernet 1	Enter interface Ethernet 1 configuration mode
Router1(config-if)#ip ospf cost 5	Change interface cost to 5
Router1(config-if)#end	Exit global configuration mode
Router1#write	Save this configuration to the startup configuration

7. Visualization of the OSPF databases

- Visualize the *Router Link States* database: *show ip ospf database router* (or briefly *sh ip o d r*).

Entry of the *Router Link States* database related to *router* 1:

LS age: 620
Options: (No TOS-capability, DC)
LS Type: Router Links
Link State ID: 20.20.20.1
Advertising Router: 20.20.20.1
LS Seq Number: 80000016
Checksum: 0x94D9
Length: 48
Number of Links: 2

Link connected to: a Transit Network
(Link ID) Designated Router address: 20.20.20.1
(Link Data) Router Interface address: 20.20.20.1
Number of TOS metrics: 0
TOS 0 Metrics: 10

Link connected to: a Transit Network
(Link ID) Designated Router address: 10.10.10.2
(Link Data) Router Interface address: 10.10.10.1
Number of TOS metrics: 0
TOS 0 Metrics: 10

In this example, it's possible to verify that the ID of this router is 20.20.20.1 and it is connected to two transit networks, that is, networks with more than one router. For the first network, the router interface with address 20.20.20.1 and a cost of 10 is connected to network whose ID is 20.20.20.1 (the address of the network *Designated Router* interface). For the second network, the router interface with address 10.10.10.1 and a cost of 10 is connected to network whose ID is 10.10.10.2 (the address of the network *Designated Router* interface).

- Visualize the *Network Link States* database: *show ip ospf database network* (or briefly *sh ip o d ne*).

Entry of the *Network Link States* database related to network 20.20.20.0:

Routing Bit Set on this LSA
LS age: 1459
Options: (No TOS-capability, DC)
LS Type: Network Links
Link State ID: 20.20.20.1 (address of Designated Router)
Advertising Router: 20.20.20.1
LS Seq Number: 80000011
Checksum: 0x359
Length: 32
Network Mask: /24
    Attached Router: 20.20.20.1
    Attached Router: 30.30.30.1

In this example, it's possible to verify that the ID of this network is 20.20.20.1 (its *Designated Router* interface address, which is *router* 1 in this case), and the *Advertising Router* is *router* 1 (ID 20.20.20.1). It is a class C network and its attached *routers* are identified the ones with Router ID 20.20.20.1 and 30.30.30.1 (*routers* 1 and 2, respectively).

8. Routing tables of routers

The routing tables can be consulted using command *show ip route*. With static routes, the routing table is (*Router* 1 of Figure 1):

```
C    10.10.10.0/24 is directly connected, Ethernet0
C    20.20.20.0/24 is directly connected, Ethernet1
S    30.30.30.0/24 [1/0] via 20.20.20.2
```

After RIP protocol, the routing table is (*Router* 1 of Figure 1):

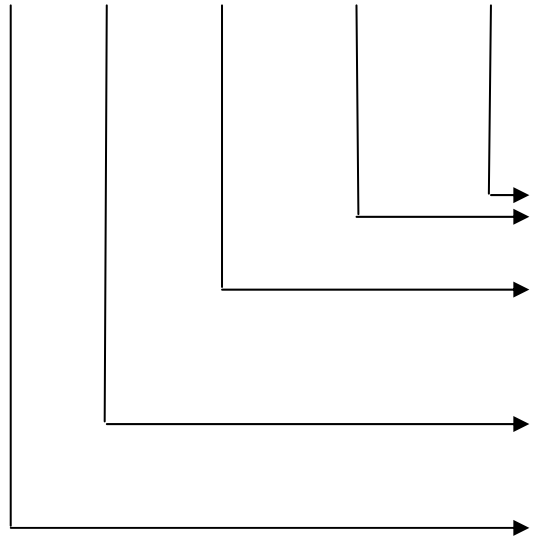
```
C    10.10.10.0/24 is directly connected, Ethernet0
C    20.20.20.0/24 is directly connected, Ethernet1
R    30.30.30.0/24 [120/1] via 20.20.20.2, 00:00:16, Ethernet1
                   [120/1] via 10.10.10.2, 00:00:12, Ethernet0
```

After OSPF protocol, the routing table is (*Router* 1 of Figure 1):

```
C    10.10.10.0/24 is directly connected, Ethernet0
C    20.20.20.0/24 is directly connected, Ethernet1
O    30.30.30.0/24 [110/10] via 20.20.20.2, 00:00:16, Ethernet1
                   [110/10] via 10.10.10.2, 00:00:12, Ethernet0
```

The interpretation of the previous routing tables is:

R 30.30.30.0/24 [120/1] via 20.20.20.2, 00:00:16, Ethernet1



Router output interface for sending packets (inexistent on static route entries).
Table entry age (inexistent on static route entries).
IP address of next hop.
The protocol priority (1 for static route entries, 120 for RIP entries and 110 for OSPF entries) and the cost of the path towards the destination network.
Destination IP network and the number of bits equal to 1 in the netmask (for example, 30.30.30.0/24 defines the netmask 255.255.255.0)
Indicates the routing method; S for static routes; R for RIP learned routes; O (IA) for OSPF learned routes (IA – inter area routes.